A Cold Boot Voltage Selector

This mod is something I had considered for a long time, but I had never done it due to the perceived difficulty of insulating the CPU pins from the motherboard. But with the Tualatin mod I developed a method of doing just that. So finally a cold boot voltage selector came within reach. Read on...

The Reasons

Given the board has the option within the BIOS setup to select the cpu voltage, why would anyone implement a manual voltage selector? Well, there are a few good reasons. For starters, the CPU always starts with its default voltage upon cold boot. So you can never overclock to a clock speed that requires a higher voltage right from the beginning. This is the major gripe I have with the Asus CUBX. The only other one is the limited number of FSB options, but that one is less critical.

It is also more practical during experiments, since otherwise the BIOS must complete a boot sequence before a changed voltage setting becomes active. A very annoying quirk of the CUBX.

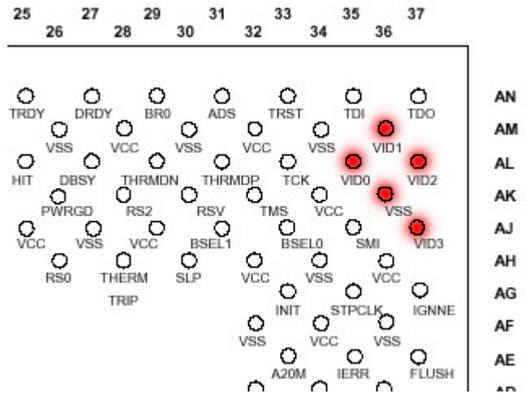
One way to overcome the cold boot issue is vid pin modding. However, this will only give you limited options since you can only pull signals down to logical zero, you cannot lift them up without physical destruction. The vid pin modding may also lead to mechanical issues, depending on the method used. Either the CPU is not sitting flat on the socket, or pins are in danger of getting bent, or you might short CPU pins.

Also it is cumbersome to make changes. And changes might be required because the BIOS setup only allows to raise the default voltage, not to lower it. So you cannot hardwire a high voltage to be on the safe side for your experiments, and choose to lower it to the required level in the BIOS.

Btw, I still think the Asus CUBX is one of the best BX boards. I just made it better. Similar restrictions apply to other boards, and this mod could be done on most other boards in just the same way. On Slot 1 boards there is usually no need, since you can always use a slotkey and a socket CPU. Most slotkeys provide a voltage selection on board.

The Plan

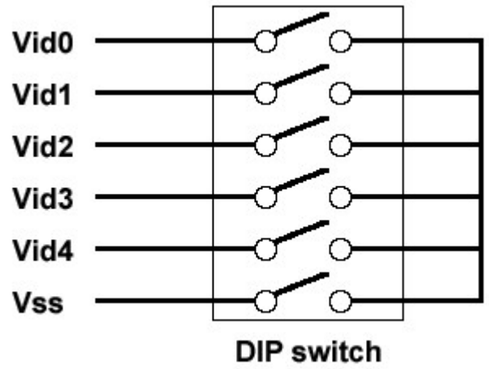
So what is the way out of this? We simply drop the premise about not allowing physical destruction and replace the signals provided by the CPU with our own signals. Let's have a look at the pinout of the Coppermine CPU:


25 27 29 31 33 35 37
26 28 30 32 34 36
TRDY DRDY BR0 ADS TRST TDI TDO AN
VSS VCC VSS VCC VSS VID1 AM
HIT DBSY THRMDN THRMDP TCK VID0 VID2 AL
PWRGD RS2 RSV TMS VCC VSS AK
VCC VSS VCC BSEL1 BSEL0 SMI VID3 AJ
RS0 THERM SLP VCC VSS VCC AH
TRIP
INIT STPCLK IGNNE AG
VSS VCC VSS AF
A20M IERR FLUSH AE

Note that the pin AK36 is connected as Vid4 on the CUBX. Now all that needs to be done is to insulate the CPU pins marked red from the socket, and to feed in a separate set of signals. Insulating

the CPU pins is done by taking the top off the socket and removing the corresponding connectors inside. To that end we bend them back and forth until they break off.

We then connect the socket pins from underneath to a DIP switch according to this diagram:



Note that pin 6 can be connected to just any GND pin on the board. The corresponding DIP switch 6 must always be switched on to keep the back plane on GND level. We can then select the Vid pins we want to pull down to GND. The other pins are left floating which is interpreted as logical one by the input gates. The following chart contains a reference of relevant voltages (voltages above 2.1V are omitted):

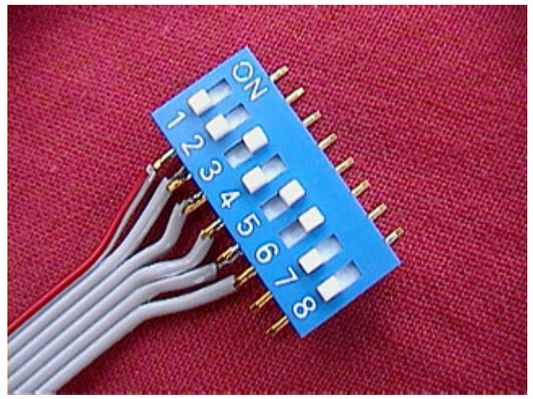
Voltage Identification Definition

VID4 (S.E.P.P. only)	VID3	VID2	VID1	VID0	$V_{CC_{CORE}}$
0	1	1	1	1	1.30
0	1	1	1	0	1.35
0	1	1	0	1	1.40
0	1	1	0	0	1.45
0	1	0	1	1	1.50
0	1	0	1	0	1.55
0	1	0	0	1	1.60
0	1	0	0	0	1.65
0	0	1	1	1	1.70
0	0	1	1	0	1.75
0	0	1	0	1	1.80
0	0	1	0	0	1.85
0	0	0	1	1	1.90
0	0	0	1	0	1.95
0	0	0	0	1	2.00
0	0	0	0	0	2.05
1	1	1	1	1	No Core[3]
1	1	1	1	0	2.1[4]

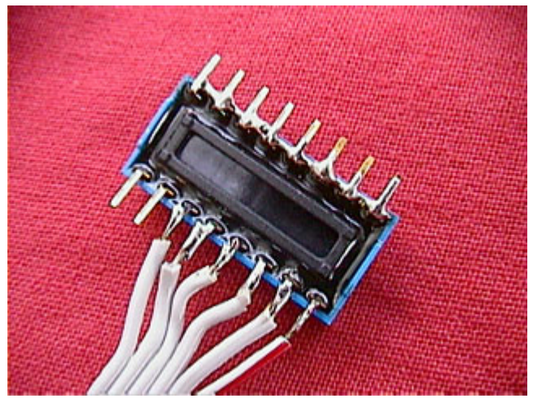
NOTES:
1. 0 = Processor pin connected to V_{SS}.
2. 1 = Open on processor; may be pulled up to TTL V_{IH} on motherboard.
3. The Celeron processor core uses a 2.0 V power source.
4. VID4 applies only to the S.E.P. Package. VID[3:0] applies to both S.E.P. and PGA packages.

The Action

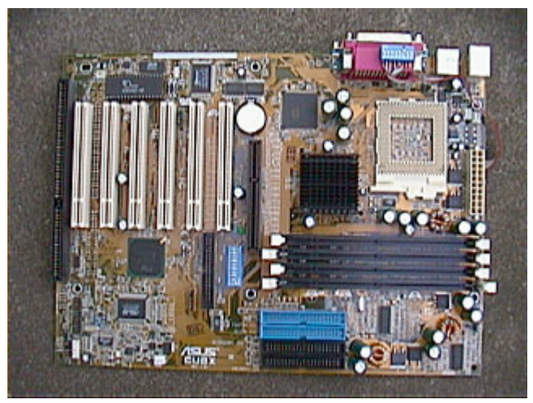
First I prepared the Selector, using a row of DIP switches and part of an old floppy cable. View from the top:



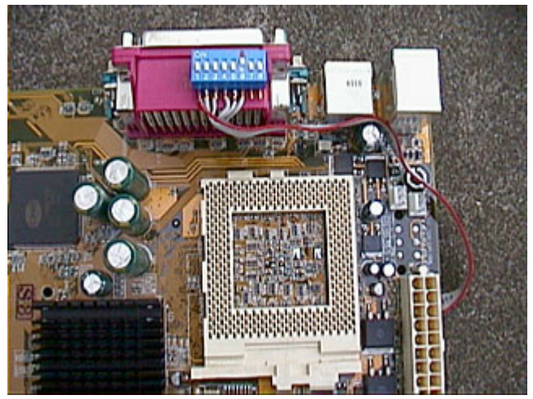
And from the bottom:



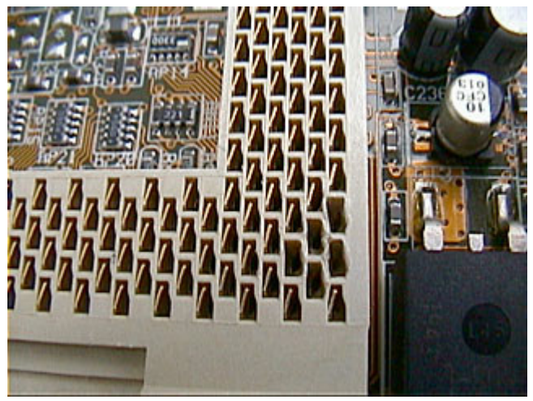
This is top of the board.



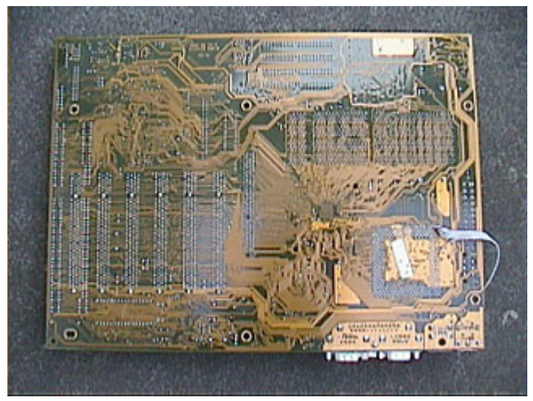
On this picture we can see the socket area in more detail. Note how I fixed the DIP switch on the printer connector. Hope this is not too much Ghetto style... ;-)



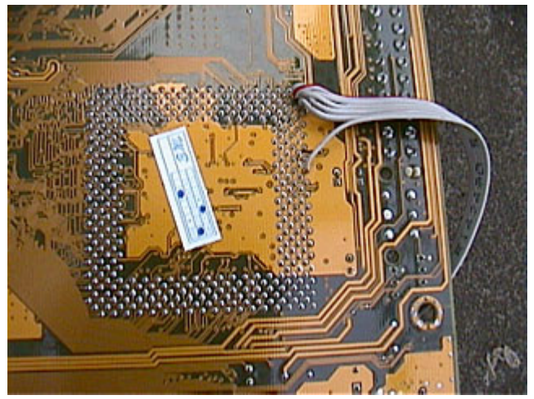
This is a close up of the socket where the vid pins used to be:



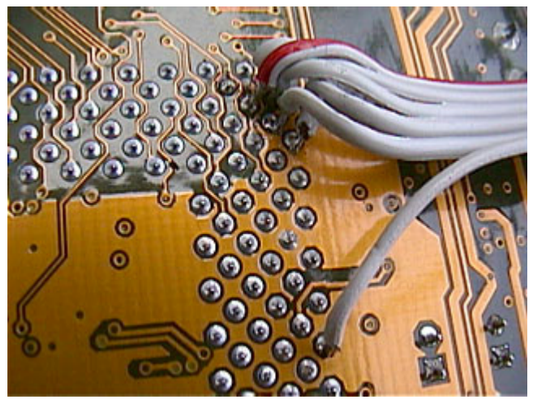
Now the same on the back side of the board. First an overview picture. Just look at those magnificent connections going from the BX northbridge to everything else...



The socket area:



And finally a close up of the solder points where the new signals are fed into the system.



So, this is the end. If this isn't nuts I don't know what is.

Martin

< Coppermine Lapping

Socket Modding for Tualatin